8 April 1993 Final Student Research Report

Marine Corps Unmanned Aerial Vehicles: Let's Do it Right

Captain Mike Ahern, USMC; Captain Pat Coronado, USMC; Captain Todd Scott, USAF; Captain Jeff Stansfield, USMC

Command and Control Systems Course
Communication Officer's School
2085 Morrell Avenue
Quantico, Virginia 22134-5058

Marine Corps University
Marine Corps Combat Development Command
2076 South Street
Quantico, Virginia 22134-5068

Thesis: In order to maximize efficiency and effectiveness of Unmanned Aerial Vehicles (UAV's), the United States Marine Corps must strive to keep its current Short Range (SR) UAV system and must also promote the consolidation of Close Range (CR) and SR UAV systems at the Remote Pilot Vehicle (RPV) Company of the Surveillance, Reconnaissance, and Intelligence (SRI) Group. This paper covers the development, use and future of the Marine Corps UAV program.

USMC; Command and Control; C2; C3; C4I; 22
Joint Command and Control; UAV; RPV; EXDRONE;
Joint Interoperability; Airspace Management;

Unclassified Unclassified Unclassified

MARINE CORPS UNMANNED AERIAL VEHICLES: LET'S DO IT RIGHT

Submitted to
Major C.J. Conlan
and Ms. Lloyd-Stanger
at the Communication Officers School
Quantico, Virginia

Captain Mike Ahern USMC
Captain Pat Coronado USMC
Captain Todd Scott USAF
Captain Jeff Stansfield USMC

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OUTLINE

THESIS: In order to maximize efficiency and effectiveness of UAVs, the Marine Corps must strive to keep its current Short Range (SR) UAV system and must also promote the consolidation of Close Range (CR) and SR UAV systems at the RPV Company of the Surveillance, Reconnaissance, and Intelligence Group.

I. Development of UAVs in support of the military.

   A. UAVs key advantages over manned aircraft are survivability and expendability.
   B. The critical factors for the Marine Corps have always been size and lift requirements.
   C. In January 1986, the Navy selected the Pioneer as its Short Range UAV.
   D. The Joint Programming Office was formed to oversee the development of interoperable systems.

II. Pioneer: The Marine Corps UAV

   A. Since 1986 Pioneer has established an outstanding performance record.
   B. The Pioneer's major drawback is its relatively short endurance time.
   C. Pioneer would benefit from an improved communications payload.

III. Hunter: Replacement for the Pioneer?

   A. The Hunter has better endurance than the Pioneer.
   B. Hunter requires almost twice the lift as Pioneer.

IV. EXDRONE: The Marine Corps' Close-Range UAV

   A. The EXDRONE is a small, simple system.
   B. EXDRONE'S drawbacks are light payloads and limited endurance.

V. How the Marine Corps should organize UAVs

   A. Fielding EXDRONES at the battalion level could be disastrous.
   B. Airspace management would be an overwhelming problem.

VI. Problem of Manning

A. Secondary MOS's should be given to qualified operators, internal pilots, and mission commanders.
B. The Marine Corps must find a way to access the pool of experienced UAV personnel.
C. Maintenance and supply problems will be extensive if CR UAVs are fielded at battalions.

VII. Recommendations for the future

A. Keep the Pioneer until a viable follow-on platform becomes available.
B. Establish a solid UAV MOS tracking system within the Marine Corps.
C. Consolidate CR and SR UAVs within the RPV Companies.

MARINE CORPS UNMANNED AERIAL VEHICLES: LET'S DO IT RIGHT

A better knowledge of the enemy's disposition of forces and his order of battle has always been fundamental to successful combat operations. Today's combat commander places a high premium on reconnaissance systems that provide real and near real-time imagery intelligence. This information is invaluable because it provides the operational commander with a significant warfighting advantage--the ability to formulate effective battle plans and to respond almost instantaneously to enemy actions on the battlefield.

Unmanned Aerial Vehicles (UAVs) hold vast potential for the future, but there are many challenges ahead for the Marine Corps' UAV program. UAVs yield significant manpower savings and enhance the performance and capabilities of Marine operating forces. Additionally, they are cost effective and extremely versatile. In order to maximize efficiency and effectiveness of UAVs, the Marine Corps must strive to keep its current Pioneer system, and must also promote the consolidation of Close Range (CR) and Short Range (SR) UAV systems within the Remotely Piloted Vehicle (RPV) Company of the Surveillance, Reconnaissance, and Intelligence Group (SRIG).

Presently, the services are at a critical point in UAV development. The Marine Corps currently employs the CR EXDRONE and the Pioneer. The SR Hunter system is presently scheduled to replace the Pioneer. The Marine Corps must examine and consider the fielding of the follow-on SR UAV system, the Hunter. The fielding of the Hunter system presents many challenges. Many in the Fleet Marine Force (FMF) are proponents for the continued use of the Pioneer SR UAV system vice the Hunter. The Marine Corps must consider at what level to hold the SR and CR UAV systems, and decide how to handle training and maintenance problems as well as airspace management concerns. This paper will compare the SR Pioneer and Hunter systems and will also examine the CR EXDRONE system. It will further make recommendations for the Marine Corps' direction based on the needs of the users.

DEVELOPMENT OF UAVS IN SUPPORT OF THE MILITARY

Joint Chiefs of Staff Publication 1 defines a UAV as an unmanned air vehicle capable of being controlled by a person from a distant location through a communication link. (13:1-1) UAVs are force multipliers; they deliver the capability to find and track targets and provide information that allows forces to destroy enemy assets more efficiently. These missions can be performed by manned aircraft, but the cost associated with losing a manned aircraft to anti-aircraft weaponry far outweigh those of losing an unmanned platform.

(28:41) Additionally, UAVs have smaller cross sections that make them more difficult to detect. So, while UAVs encounter the same threats faced by manned aircraft, survivability and expendability are their key advantages.

Recognizing the value of UAVs, the Marine Corps, in conjunction with the Navy, began to monitor UAV programs and activities during FY82-FY83. The Navy procured eight Mastiff UAVs in FY84 for approximately $8 million and the Army concurrently developed the Aquila UAV. The Marine Corps rejected the Aquila because of its large logistical requirement, which they considered incompatible with the Marine Amphibious Force's most probable mission of third world beachhead landings. (29:257) This rejection is a significant point of interest because it reflects the FMF's current attitude toward the Hunter. For the Marine Corps, the size and lift requirements were critical factors in the early procurement of UAVs. Essentially, these requirements have not changed for the Marine Corps, and size and lift are still pivotal considerations.

Because of this keen interest in UAVs, the Pentagon initiated a ROADMAP program in the summer of 1985. This program, designed to categorize UAVs by range capabilities, led to the elimination of many other programs that were being considered. The Navy, for instance was given the responsibility for short range, medium-range, and long range

UAVs, while the Army's responsibilities centered on the Aquila.

In July 1985, the Navy outlined desired UAV specifications and subsequently held a competition. The Navy tested and evaluated systems to determine the best platform that fit unique needs of the Navy and the Marine Corps. Specifically, the Marine Corps needed a system that did not require a large logistical support train and could be operated by a relatively small crew. Additionally, the platform had to possess the capability to perform the required missions of artillery target acquisition/determination, naval gunfire adjustments, and battlefield surveillance in urban and conventional land warfare. (29:257, 269) Today's needs are basically the same as those of 1985. Finally, in January 1986, the Navy announced that it had selected the Israeli's Pioneer as its system. Mazlat, the Israeli producer, received a contract for over $25 million for the production of three Pioneer systems. The Marine Corps presently fields the Pioneer UAV as its primary ground-launched, UAV platform. (Shown in Figure 1)

PIONEER UAV, PRODUCED BY ISRAEL AIRCRAFT INDUSTRIES LTD

FIGURE 1

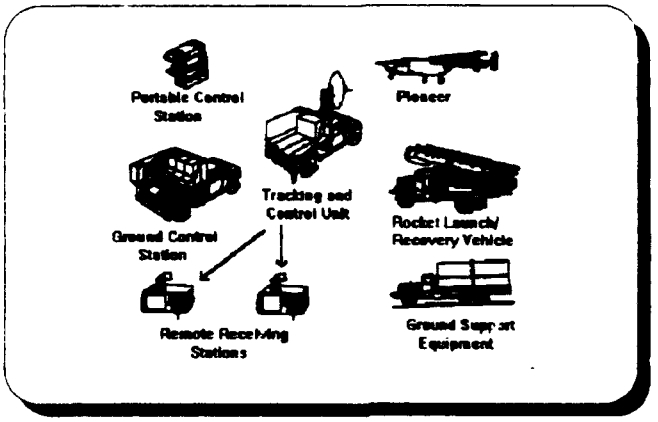
Currently, the responsibility for testing and evaluating follow-on UAVs lies with the UAV Joint Project Office (JPO) located at Pentagon City, Virginia. The Department of Defense (DOD) formed the JPO after Congress directed that an annual Master Plan be prepared to ensure that common and interoperable systems were being developed for all the services. The JPO's stated mission is to "expeditiously field quality UAV systems that provide a significant tactical advantage to the operational commanders." (29:1) The JPO is the Department of Defense's center of focus for UAVs. The JPO provides advice and guidance to other federal agencies interested in employing UAVs and provides joint funding for research, development, and procurement. However, the services provide their own funding for operations and maintenance (O&M) costs that include replacing attrited air vehicles.

PIONEER: THE MARINE CORPS' UAV

The Pioneer has a proven and well-respected performance record. Introduced to the force structure in 1986, Pioneers have operated from four battleships during deployments worldwide. Six Pioneer systems participated in Operation Desert Storm--three with 1st Marine Expeditionary Force, two with United States Navy battleships, and one with United States Army VII Corps. (29:59) During the Gulf War, the Pioneer systems provided near real-time reconnaissance, surveillance, target acquisition, artillery spotting, and Bomb

Damage Assessment during both day and night operations. (29:9)

Ideally, each system consists of eight air vehicles, a ground control station (GCS), two portable control stations, two remote receiving stations, launch and recovery equipment and transportation vehicles. (29:257, 269) (As shown in Figure 2)



PIONEER SYSTEM

FIGURE 2

However, due to real world constraints, damaged airframes and termination of production, the Marine Corps' RPV Companies often operate at levels below the specified table of equipment.

Pioneer has limitations; these were evident in Desert Storm. The system did not have the desired range or endurance required for all operations. For instance, Army VII Corps needed a system with a radius of action of about 300 kilometers and a time on station in excess of four hours at

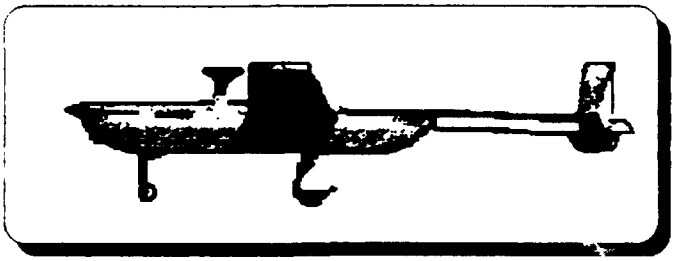
maximum range. (29:60) Characteristically, Pioneer has a maximum range of 185 km and an endurance time of four hours. (2:3) The Army needed a system with more capabilities. Pioneer's range was generally satisfactory for the USN and USMC, but additional endurance would have been welcomed.

Pioneer could benefit from a better communications payload. Presently, Pioneer can use HF, VHF, and UHF bandwidths, but because of the vast distances at which UAVs operate, the line of sight communications range is often exceeded. For example, during Desert Storm, communication links were unreliable because of long distances. This meant Pioneer could only provide limited information. An example of this was when 2nd RPV Company was put in direct support of the division. According to Major Brennan, the G-2 for 2nd Marine Division:

> While in direct support of the division, the 2d RPV Company liaison team was habitually unable to establish positive communications with company headquarters, seriously hampering coordination of flight activity and timely reporting of information. (18:28)

HUNTER: REPLACEMENT FOR THE PIONEER?

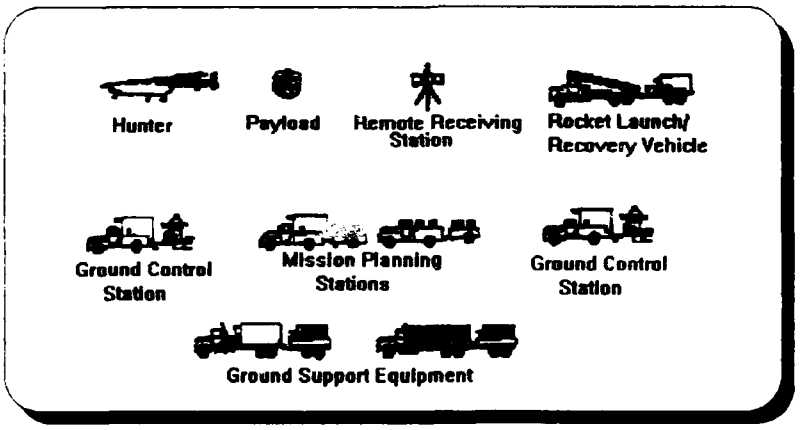
In many ways, Hunter is a more capable system than Pioneer. Hunter has a maximum range of 150 kilometers beyond the Forward Line of Troops (FLOT), an eight hour range, and Global Positioning System (GPS) navigation capability. (15:3) (2:5)(Figure 3)



HUNTER, PRODUCED BY ISRAEL AIRCRAFT INDUSTRIES LTD. AND TRW

FIGURE 3

However, Hunter is a very large system. The Hunter system consists of a Mission Planning and Control Station, which includes one mission planning station and two GCSs; remote video terminals; eight air vehicles; modular mission payloads; ground and air data terminals; launch and recovery equipment; and integrated logistics support. (29:12) (As shown in Figure 4)



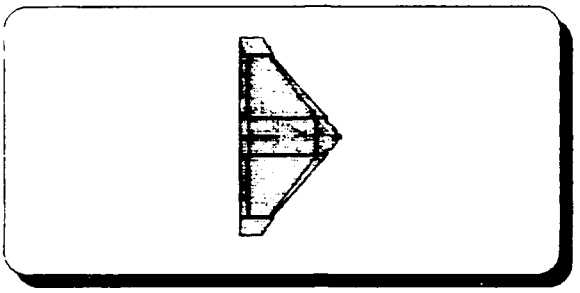
HUNTER SYSTEM

FIGURE 4

An additional GCS will provide a greater communications capability, but will also increase lift and logistical requirements. The Hunter air vehicle is almost twice the size as the Pioneer and weighs three times as much. (22:2) Four C-5s and two C-141s are required to lift an RPV Company using Hunter; Pioneer requires only two C-5s and three C-141s. Pioneer has already been dropped from some exercises because of its large airlift requirement. (2:2) Yet the Marine Corps is contemplating acquiring the significantly larger Hunter.

EXDRONE: THE MARINE CORPS' CLOSE-RANGE UAV

During Desert Storm, EXDRONE was used successfully to augment the Pioneer. It was employed to support battalion and higher sized units. It has a range of 50 kilometers beyond the FLOT, carries a 25 pound payload, and has an endurance of two and a half hours; it is a relatively small system that requires a 2-3 man team to operate. (29:47,48) During Desert Storm, its smaller cross section made it more difficult to detect. Because EXDRONE is inexpensive, it is intended to operate in areas where it is reasonable to expect air vehicle losses. EXDRONE is expendable when the mission requirements override equipment survivability considerations. In most cases, however, the CR UAV will be recovered after mission completion. (31:5) (Figure 5)



EXDRONE UAV, PRODUCED BY BAI AEROSYSTEMS, INC.

FIGURE 5

Although EXDRONE is a valuable and affordable asset, it has many limitations. It has a day-only camera with no zoom capabilities or variable field of view. This means that the airframe must be maneuvered and adjusted to obtain the best picture, which reduces the effectiveness of the EXDRONE. However, adding a gimbaled payload, Forward Looking Infrared Radar camera and a zoom capability will add a significant amount of weight, probably superseding the airframe capabilities. Another limitation of EXDRONE is its lack of automatic navigation. The operator is dependent on locating terrain features to orient himself as to where the aircraft is flying. (17:46)

HOW THE MARINE CORPS SHOULD ORGANIZE UAVS

The current plan will deliver 14 SR Hunter systems and 136 CR EXDRONE systems to the Marine Corps by FY96. (20:1,2) Some Hunter assets will reside with the RPV Companies and some assets will be for wartime reserves and maritime

prepositioning. The Marine Corps will field EXDRONE at the RIV companies and at the battalions, with additional assets going to the wartime reserves and maritime prepositioning. (31:3, 32:3)

The fielding of CR UAVs at the battalion and battery levels could be disastrous. In this situation, airspace management becomes a monumental problem. From an aviation command and control standpoint, having air platforms launched, controlled and recovered autonomously at a battalion level would be exceedingly dangerous. Fielding systems at the battery and battalion levels would most likely saturate the division's close-in air space and present tremendous air space and frequency coordination problems that the division could not handle.

This concept is similar to placing tactical aircraft such as AV-8s and AH-1s in direct support of battalions. Giving a battalion the asset to employ as it sees fit is an attractive concept because it facilitates flexibility and response time. Conversely, it creates an unsafe situation without centralized control of air assets without deconfliction with other aircraft and supporting arms. The planning, coordination and execution of these air vehicles at the battalion level are major safety concerns. Detailed command, control and communication procedures must be established; otherwise, the lives of Marines will be jeopardized.

THE PROBLEM OF MANNING

With a shrinking monetary budget and changing worldwide threats, the Marine Corps must ensure that a solid plan is developed that most efficiently and effectively employs Marine Corps UAVs. A critical part of this plan is manning. A secondary Military Occupational Specialty (MOS) for officers and enlisted who have UAV experience has already been created, but the Marine Corps needs to ensure that a system is in place to track these individuals.

With plans to accept the Hunter UAV into Marine Corps inventory as early as FY94, the Marine Corps must establish a solid concept of operations with emphasis on minimizing manpower, training and O&M costs. The Marine Corps must look at all levels of usage, maintenance and supply within the Marine Corps to develop this plan. The mission and tasks required must not be jeopardized, and manning plans must take into consideration a more sophisticated threat and a technologically advanced environment. Fielding systems at the battalion level without appropriate manpower to dedicate to a skill intensive system would be self-defeating. (30:17) The training and experience of personnel can be maximized by placing UAVs in the RPV Company,. The current plan for the CR UAV system identifies an increase of three personnel at the regimental level with additional operators/maintainers coming "out of hide" from organic assets. (29:4) This concept will

not optimize training or personnel or maintenance of the systems. By consolidating both the CR UAV and SR UAV in the same unit, the Marine Corps can build on the commonality and interoperability of the systems for training, safety, and maintenance. This consolidation must include appropriate MOS tracking.

RECOMMENDATIONS FOR THE FUTURE:

CONSOLIDATION OF UAVS AT RPV COMPANIES

It is extremely prudent to consolidate CR and SR UAVs at the RPV Company where standard maintenance, safety, and training procedures already exist. If the Marine Corps stays with the current plan to train operators and maintainers from "out of hide," Marines in these units will have to undergo specialized maintenance and operator training in addition to training in their specific (MOS). The battalions can train "out of hide" operators and maintainers, but it will be difficult and costly. By not consolidating, different safety and maintenance efforts will most likely develop leading to fragmented programs and a potentially wasteful endeavor. This consolidation will not prevent the lower echelons from receiving the support they need. Task organized detachments of CR and SR UAVs will be employed to best support these units based on specific requirements.

Additionally, consolidation of UAVs at the RPV Company will simplify airspace management. All coordination measures

and control procedures should be maintained by the company and should be coordinated with the appropriate Marine Air Command and Control System agency. All measures and procedures must be included in the annex M portion of the Operations Order and in the Pilot Controller Handbook. Further, all missions should be treated as any manned aircraft flight and included in the daily Air Tasking Order with pertinent Special Instructions annotated. If CR UAVs are held at battalion and battery level, this information would not be timely and airspace management would be a nightmare. The chances for midair collisions would increase exponentially.

UAVs owned by the battalion may be more desirable for the battalion commander, but this plan will significantly diminish the MAGTF commander's control of his assets and the overall mission. Finally, fielding UAVs at the battalion level would eliminate the Marine Air-Ground Task Force Commander's flexibility in tasking UAVs. The platforms would be out of his hands and could not be quickly diverted for higher priority missions.

ESTABLISH A MOS TRACKING SYSTEM

Resident expertise in the UAV community is a current problem. Currently, secondary MOS's are assigned to qualified mission commanders, internal pilots, and operators. However, there is no mechanism in place to adequately track these individuals after they are transferred from an RPV Company.

This vast wealth of knowledge is lost and new personnel must relearn those lessons that were learned by previous personnel.

This is not to say that individuals possessing a UAV related MOS will constantly be reassigned to RPV Companies. Instead it will merely give the Marine Corps a pool of skilled personnel from which to draw in time of need. Therefore, we recommend that the Marine Corps develop an efficient system to properly track those Marines with the critical low density skills required for UAV operations. This is applicable for both officers and enlisted Marines. Peacetime RPV Companies should be manned by adequate numbers of trained personnel. In times of need, additional Marines with prior UAV expertise could be located quickly and subsequently assigned to RPV Companies.

CONTINUED USE OF THE PIONEER SYSTEM

The Marine Corps should extend the current life cycle of the Pioneer System. The follow-on SR UAV, the Hunter, is too big for the Marine Corps. Although it incorporates many of the desired capabilities requested in a follow-on system to the Pioneer, its size is prohibitive.

If the Marine Corps keeps Pioneer, a logistical support system must be implemented to allow the system to continue to operate. Currently, there is not an aviation supply system in place to support Pioneer's needs. When replacement parts for UAVs are not available, units are often forced to cannibalize

other vehicles to keep a minimum number of UAVs flying. This is unacceptable.

Therefore, it is highly recommended that the Marine Corps continue to field the Pioneer system as the primary SR UAV. The Marine Corps should continue to develop and upgrade the Pioneer system with off-the-shelf technology until an appropriate follow-on platform that meets the Marine Corps needs becomes available.

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